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Electronic Gating Circuit and Ultraviolet Laser Excitation Permit Improved Dosimeter Sensitivity

The problem:

To increase the readout sensitivity of photoluminescent dosimeter systems. The sensitivities of dosimeter systems available prior to this technique were limited to relatively large radiation doses, on the order of one roentgen. This limitation was caused by light from "pre-dose" fluorescence and from the visible light component of conventional ultraviolet (UV) sources which made sensing of low dosages difficult. A technique was required which would permit accurate determination of exposure to low radiation doses.

The solution:

A standard dosimeter reader is modified by adding an electronic gating circuit to trigger the intensity level photomultiplier. The gating circuit, in turn, is controlled by a second photomultiplier which senses a short (10 to 20 nanosecond) ultraviolet pulse from a laser used to excite the dosimeter. The gating circuit provides a time delay in the photomultiplier, preventing it from reading light from "pre-dose" fluorescence. The laser provides a fast cutoff of the ultraviolet light excitation intensity and eliminates visible light from the exciting source.

How it's done:

The factor that complicates the sensing of extremely low (milliroentgen range) radiation dosages are the presence of "pre-dose" fluorescence and visible light emitted by the ultraviolet source. The "pre-dose" fluorescence, which has a decay time of about 0.3 microsecond, is emitted by the silver phosphate glasses of the dosimeter. This is a shorter decay time than that of the ionizing radiation (3 microseconds), and

it is this decay time differential which is used as the means of separating them.

The modified dosimeter was tested by removing its ultraviolet source and cutting a hole in its back panel to introduce the laser beam. The electronic gating circuit permitted the photomultiplier to be triggered and become a detector after a 1-5 microsecond delay so that only the ionizing radiation would be detected. The photomultiplier response was observed on an oscilloscope. Preliminary studies of the laser beam as a radiation source indicated that the sensitivity of the dosimeter could be improved by at least two orders of magnitude.

Notes:

1. Additional details concerning this innovation are contained in *UV Laser Excitation for Ultra-Sensitive Photoluminescent Dosimetry*, a reprint from *Solid State and Chemical Radiation Dosimetry in Medicine and Biology*, IAEA (International Atomic Energy Agency), Vienna, 1967, p. 115-120.
2. Inquiries concerning this innovation may be directed to:

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(continued overleaf)

Patent status:

Inquiries about obtaining rights for commercial use
of this innovation may be made to:

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